SCIENTECH.

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November 15, 2004 Final Report #21-04-02

NRC Operations Center
Document Control Desk
US Nuclear Regulatory Commission
Washington DC, 20555

POTENTIAL DEFECT UNDER 10CFR21

Dear Sir or Madam:

On October 28, 2004 SCIENTECH LLC provided you with an initial facsimile report pertaining to a 10 CFR 21 reportable situation involving electronic modules supplied to the First Energy Beaver Valley nuclear plant by NUS Instruments LLC, a Subsidiary of SCIENTECH LLC.

This report provides additional details of the investigation and an account ofactions taken subsequent to the initial report.

NUSI LLC Contacts

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If you have any questions or comments, please contact us at the numbers given above.

Sincerely,

Harold Burton
President, NUSI LLC

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Name of Reporting NUSI LLC Individual or Organization and Address:

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Identification of the facility, activity, and Basic Component supplied for such facility or activity within the United States which fails to comply or is believed to contain Deviations or potential Defects:

In July 2004, at First Energy's Beaver Valley Unit 1 nuclear station, an NUS Instrument complex math module, model CMM801, serial number 301759, failed. The CMM801 was being used in a safety related feedwater control circuit. It was replaced with CMM801 serial number 301758. The second CMM801 failed on August 1, 2004.

Identification of the SCIENTECH Group/Segment or Subsidiary that supplied the Basic Component:

NUS Instruments LLC, a Subsidiary of Scientech LLC
200 South Woodruff Avenue
Idaho Falls, ID 83404

Nature of the suspected Defect or failure to comply, and the safety hazard which is, or could be, created by such Defect or failure to comply and the date this information was obtained:

Beaver Valley returned both modules to NUS Instruments by 8/23/04. Our investigation showed that the 32 vdc power supplies internal to both modules, Kepco power supply model FCP-032K, had failed to approximately half output. The power supplies are bought by NUS Instruments from Kepco as commercial grade items and are dedicated for safety related use as part of a larger module assembly. Both power supplies, serial numbers 37401342F and 37401311F, were removed and forwarded to Kepco for failure analysis on 8/27/04. After an initial visual inspection, Kepco forwarded the power supplies to TDK-Japan, their manufacturer.

A preliminary failure analysis provided on 9/20/04 pointed to a possible manufacturing error in the FCP-032K power supplies. NUS Instruments initiated Non-Conformance Report 04N-100 on 9/21/04. Due to the potential for common mode failure, the NCR process initiated a 10CFR21 evaluation on 9/27/04.

A final failure analysis was provided by the manufacturer on 10/11/04. It determined that the power supplies in both modules failed because of a manufacturing error. A surface mount tantalum capacitor - C53 - was installed with reversed polarity. The capacitor is lightly loaded in an operating power supply, so it may take an extended period of operation to fail. This explains why neither the NUS burn in test nor the separate and additional Beaver Valley burn in test failed to find the problem.

The FCP-032K supply is in the current driver circuit of the CMM801. The result of the failure is to limit the output of the current driver circuit - it will work properly at low inputs, but will not provide more than approximately 16 ma output current – below the required 20 ma. Therefore, changing plant conditions

may not be properly reflected in the instrumentation and, in a worst case, trips of multiple channels of safety systems may be affected.

The number and location of all such basic components of the same type which are in use at, supplied for, or being supplied for one or more facilities or activities subject to the regulations of 10 CFR 21:

In April of 2003, TDK-Japan moved the manufacturing of this product from a plant in Taiwan to a plant in Xiamen, China. The plant in Taiwan used automated placement equipment; this equipment was not originally installed in the Xiamen plant. Surface mount capacitor C53 was placed by hand until 28th July of 2004. Based on the results to date, the factory personnel placing the capacitor were unaware that there was a required polarity and approximately 50% of the capacitors were installed backwards. After July 2004, all parts were correctly placed by machine.

Some Kepco FCP-032Ks have eight digit serial numbers. The first three digits encode the year, month (1-9, X, Y, Z), and location of manufacture, while the last five are a sequential serial number. The eight digit serial numbers of the at risk population start with 344, 354, 364, 374, 384, 394, 3X4, 3Y4, 3Z4, 414, 424, 434, 444, 454, 464, and 474.

Other Kepco FCP-032Ks have five digit serial numbers. The first three digits encode the location, year, and month (1-9, 0, 1, 2) of manufacture, while the last two digits record the day of manufacture (1-31 thru September, 51-81 for October, November, and December). The five digit serial numbers of the at risk population start with 434, 435, 436, 437, 438, 439, 430, 4315, 4316, 4317, 4318, 4325, 4326, 4327, 4328, 441, 442, 443, 444, 445, 446, and 447.

All failures to date happened within about 1000 hours of service. Based on information from Kepco and TDK-Japan, the manufacturers, any FCP-032K power supply that has successfully operated for 3000 hours in an NUSI module has demonstrated that C53 is installed correctly. Three thousand hours is a very conservative number chosen to give a very high degree of confidence that all failures will be enveloped. Note that the ability to reach 100% span after 3000 hours must be confirmed.

Therefore, the population at risk includes modules using Kepco FCP-032K power supplies with serial numbers listed above that have not yet been in service for at least 3000 hours, or have been in service for at least 3000 hours but have not demonstrated their ability to reach 100% span..

NUS Instruments LLC Affected Scope:

Power supplies manufactured before March 2003 are not at risk. The Kepco FCP-032K power supplies bought on purchase order 02-377 were receipt inspected on 10/22/02; since this is before the start of the risk period on March 2003, modules using power supplies from purchase order 02-377 or prior purchase orders were removed from the at risk population.

The corrective actions for NCR 04N-100 included a 100% inspection of all Kepco FCP-032K power supplies built during the suspect period. The corrective actions were implemented on 10/04/04; therefore, modules that were shipped after this date or are awaiting shipment wereremoved from the risk population.

Some modules supplied to Beaver Valley already had their Kepco FCP-032K power supplies replaced with new supplies visually confirmed to have proper capacitor placement during the initial actions to respond to the CMM801 failures. These were removed from the risk population.

NUS Instruments traced where the Kepco FCP-032K power supplies bought since PO 02-377 were used. A table listing the job, the module type, the material withdrawal, and the number of FCP-032K power supplies used for each of the at-risk POs was prepared and sent to affected clients.

NUS Instruments then traced the job and module type to determine the client and serial numbers of the at risk modules. A second table listing the job, client, module type, and safety related status of the at risk population was also prepared and sent to affected clients. In summary, there are 228 modules at risk, 195 of which were sold for safety-related service. Overall, a total of 10 nuclear utility client plants are affected.

Utility Affected Scope:

NUS Instruments is unable to determine if the Kepco FCP-032K power supplies delivered by NUS Instruments to our clients have been in use for at least 3000 hours; supplies in use for at least 3000 hours that still function properly have proven correct assembly by test.

NUS Instruments is unable to determine if other safety related instrumentation at any nuclear plant uses a Kepco FCP-032K power supply manufactured during the at-risk period. As Kepco is a commercial grade supplier, they are not under obligation to meet the reporting requirements of 10CFR21, nor do they have a nuclear grade Quality Assurance program.

Description of contributing causes, the corrective action which has been, is being, or will be taken; the name of the individual or organization responsible for the action; and the length of time that has been taken or will be taken to complete the action:

No contributing causes were identified. The critical characteristics of the power supply were properly identified. The manufacturing error was such that the device failed only after several hundred hours, so acceptance testing and burn in testing did not detect the error. The surface mount capacitor is very small, and the power supply units themselves are enclosed in a plastic housing, so the error was not visible.

Upon identification of the manufacturing defect, NUS Instruments initiated a 100% visual inspection to confirm the proper polarity of C53 in the Kepco FCP-032K power supplies. This will be amended to require visual inspection of any Kepco FCP-032K power supply with a serial number in the at-risk population.

NUS Instruments took action on 10/29/2004 to notify all affected clients of the potential problem, including information to allow the clients to perform their own visual inspection to confirm proper orientation of C53. NUS Instruments will accept the return of at risk modules, check the FCP-032K for proper assembly, and replace any defective power supplies at our client's request.

Advice related to the Deviation, Defect, or failure to comply about the facility, activity, or Basic Component that has been, is being, or will be given to the purchasers or licensees:

As noted, an advisory letter was issued to each of the affected clients on October 29, 2004, explaining the problem and explaining how to determine if their at-risk module has a faulty capacitor placement. NUS Instruments included the following advice:

- If the at risk module has been in operation for at least 3000 hours and the module performs correctly, no corrective action is required, in that the capacitor placement has been proven by test.
- If the at risk module has not been in service for at least 3000 hours, examine the Kepco FCP-032K power supply at your earliest convenience to determine if that particular FCP-032K was assembled correctly.

Affected Clients:

Entergy – Fitzpatrick
Entergy – Indian Point 2
Entergy - Indian Point 3
Entergy – Pilgrim
First Energy – Beaver Valley
NMC – Duane Arnold
NMC – Kewaunee
Public Service Electric & Gas - Salem
Rochester Gas & Electric - Ginna
TVA – Watts Bar

References: Client Advisories

Technical Advisory: Volume 18 Kepco FCP-032 Failures, November 2004
Table: Use of FCP-032Ks by Purchase Order
Table: At Risk Modules by Client

End of Report